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TEXT: Cognitive learning related to the environment has typically been subsumed as a part of instruction in the more traditional areas of the secondary school curriculum, in particular in science and/or social studies classes. Because few secondary schools

include discrete subjects in environmental areas in their curricula, presentation of environmental concepts generally is accomplished through use of the same instructional techniques as those employed in the courses in which they are considered, generally focusing on in-the-classroom learning.

A unique feature of environmental education is its intimate identification with outside-the-classroom phenomena. However, the typical pattern employed in such "in-the-environment" learning as does exist is to concentrate on the affective, frequently the motivational, aspects of outdoor education and field instruction. Most of the research dealing with learning in the environment centers on non-cognitive areas (Disinger, 1984).

Field instruction for cognitive purposes is not an innovation of this era. Attempts to instruct in the field have been charted through the centuries, up to and including the present. Socrates and Aristotle led their followers directly to the natural environment for observation and discussion about nature; expressions of similar efforts still are being evidenced.

Even though general sentiment is supportive of the value of learning in a direct environmental setting, actual efforts at implementation of field instructional programs have been limited. Mason (1980) identified a number of factors contributing to limited instructional use of field activity, among them lack of planning time, lack of resource people for assistance, failure of the school to assume trip risk, lack of a satisfactory method of covering other classes, restrictions placed on field work by school regulations, lack of administrative leadership, support, and encouragement, lack of funding, limited available transportation, too much "red tape," and excessive class size. Disinger (1984) additionally suggested a lack of teacher commitment to the concept of the field instruction--"it is 'easier' to teach in the classroom than to plan and implement outside-the-four-walls initiatives."

EARLY STUDIES

Schellhammer (1935) investigated knowledge gains of two groups of high school biology students. His study covered a period of one year. Experimental and control groups were established, with the experimental group participating in a field excursion. Posttests were given to both groups; knowledge gains were found to be significant only with the experimental group. The groups were reversed (control becoming experimental, and vice-versa), and a new unit of study was taught following the same procedures. The new experimental group showed more significant gains than did the new control group.

The impact of extended excursions was studied by Raths (1936) with students who were taken to the coal fields of West Virginia on a ten-day trip. Students who had participated in the trip were judged to be superior in their abilities to evaluate tasks

related to scientific inquiry, when compared to non-trip students.

Fraser (1939) worked with the same group of students as did Raths, but focused on gains in information that trip-students had evidenced. He distinguished knowledge gain from memorized information. Measurements of students' abilities to generalize and apply principles learned were made. He concluded that the greatest value of learning in the field was skill in knowledge acquisition and application.

Atyeo (1939) conducted a study in which he compared the results obtained from the use of an excursion technique with those of other teaching methods. He found that with an increase in excursions there was an increase in investigating the phenomena associated with the experience, and demonstrated that the excursion technique was superior to class discussion for teaching material requiring comparisons and knowledge of concrete objects.

When testing the usefulness of field trip guidebooks, outlines, instructonal materials, and associated techniques, Evans (1958) found that classes that used the planned field trip technique learned more, retained more, and did better on tests than did classes not participating in field trips.

Testing the effectiveness of field trips in the teaching of college-level botany classes, Kuhnen (1959) found that groups actively involved in field trips showed some, but limited, superiority in knowledge gain over control groups instructed in a laboratory setting.

STUDENTS OF VARYING ABILITIES

enz (1962) conducted an experimental evaluation of field trips for achieving informational gains in an earth science unit. Four classes of ninth graders (n=109 students) participated in the study. The experimental groups went on excursions to sites of geologic interest, while the control groups remained in the classroom and reviewed the content through slides. Based on comparisons of pretest and posttest results, Benz concluded that superior students tend to profit more from field trips than do students with average to less-than-average ability, but that field trips may contribute to the understanding of scientific principles for all students.

A comparison of two instructional methods--field instruction and discussion--was undertaken in a study by Bennett (1963). A unit on ecology was taught by both methods to separate groups of seventh graders. Bennett found no significant gain from the experimental field treatment as compared to the traditional classroom discussion method, but noted that the field experience technique was as effective as the discussion technique.

The effectiveness of learning geology through field experiences was probed by Glenn (1968), whose study involved a comparison of the field technique to the use of color

slides with classroom discussion. In none of the comparisons did the field trip group score significantly higher than did the group taught with slides.

Goldsbury (1969) made a similar comparison, examining the effects on cognitive learning from the substitution of slide-tapes for an actual field experience. Test results indicated that the vicarious experience afforded through the slide-tape presentations was more effective than direct exposure to field trip experiences. However, direct experiences in the field coupled with exposure to slide-tapes in the classroom proved to be a more effective approach than either, separately.

Significant increases in student test scores resulted from use of pre-trip instructional materials, according to the results of a cognitive-gain study on a museaum field trip experience for junior high school earth science students (Gennaro, 1981). An experimental group demonstrated statistically significant differences in gain scores as compared to a control group making the same field trip, but without pre-trip instruction.

In research conducted by MacKenzie and White (1982), the effects of field work on retention levels were examined among eighth and ninth graders in Australia. Three groups of students were involved. The same general learning program was employed in all treatments, but with different approaches to the excursion phase; there was an active processing excursion group, a traditional passive excursion group, and a group that did not have field work. Two tests were given, one on achievement of unit objectives and the other on formation of episodes and linking them with other knowledge items. Both tests were given prior to formal instruction; posttests were given during the summer holidays, just prior to the beginning of the new school year. Posttest results indicated that the students who had field work performed better than did students who did not have either field component of instruction. Retention was superior in the group that participated in the active excursion program.

To evaluate the effects of field activities on student learning, Kern and Carpenter (1986) conducted a study with two sections of a college laboratory course in earth science. One section involved primarily classroom activities using a laboratory manual, while field-oriented activities were employed in the other. Comparisons of the performance of the two classes at the end of the term revealed almost identical levels of lower-order learning (recall), but higher-order skills were demonstrated to a greater degree by the field-oriented section, indicating an enhanced ability to apply the information acquired.

UNDERSTANDING AND RETENTION

Designed to examine the nature of ideas that students hold about specific scientific concepts and to investigate modes of instruction that would effectively help them gain an accurate understanding of their world, Lisowski's study (1987) focused on students' conceptions of ecological concepts and the influence of field instruction strategies on their understanding and retention of these concepts. An experiential seven-day field

program served as the learning strategy for three independent groups of secondary students. These students responded to a specially designed cognitive instrument made up of higher-order items prior to, during, and four weeks after the field program. All groups exhibited significant posttest gains and showed evidence of retention of the targeted concepts. Gains in scores in the major concept strands were positively related to the instructional emphasis given to those areas. The effectiveness of the field program was apparent, in that the specific concepts emphasized were learned and retained.

In Wise and Okey's meta-analysis of instructional strategies (1983), one category examined was presentation mode. This category included those means of instruction where the setting was different from a traditional learning environment; field instruction was a targeted mode of learning within this category. Th mean effect size obtained for cognitive and other (attitudinal, problem-solving) outcomes was .26, based on 103 studies. Thus, field instruction was usually found to be more effective than traditional strategies of learning.

Summary

The relative sparsity of research literature dealing with cognitive learning about the environment, in the environment, is an indication that little cognitive instruction in secondary schools takes place in field settings. However, those studies which have been reported indicate that field-based instruction is a teaching technique worthy of additional, extensive rigorous study by educational researchers. The research data reviewed indicate that there are substantial achievement differences in the effectiveness of different approaches to field-based instruction. Both teachers and investigators should study successful approaches to improve their work.

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